Purpose:
Provide a hands-on experience for Project Management (PM) professionals for application of Complex System Governance (CSG) concepts.

Objectives:
- Examine the nature and implications of the complex problem domain facing PM professionals.
- Explore CSG as a systems-based response to better deal with increasingly complex projects.
- Apply CSG methods to discover ‘deep system’ failure modes in design, execution, or development of projects.
- Determine feasible strategic responses to preclude or mitigate CSG failure modes in complex projects.

Workshop Schedule (9:00 – 5:00):

9:00 – 9:15 Kickoff and Introductions
9:15 – 10:30 P1 CSG: Problem Domain & Introduction
       Exercise in Complex Problem Domain
10:30 – 11:00 Morning Tea
11:00 – 12:30 P2 CSG Foundations and Fundamentals
       Exercise in CSG
12:30 – 1:30 Lunch Break
1:30 – 3:00 P3 CSG Application for Complex Projects with
       Exercise in action
3:00 – 3:30 Afternoon Tea
3:30 – 5:00 P4 Addressing Failure Modes in CSG
       Exercise in CSG Failure Modes
       Workshop Closeout
People talk about systems (projects) ……..

I hate this !@*&$# Project
Trash it and start over
Slip the schedule and hope

But what if projects could talk about people?

I hate those !@*&$# humans, no respect
We should blow budget, that’ll show’em
Ignored, abused, they don’t love us anymore, let’s fail

The Problem Domain

All complex systems exist within a domain?

The complex system problem domain
Crosses a holistic spectrum of dimensions
Is unique for each complex system

It’s a little bit more complex than that

Ouch!! That’s going to make a mark!
This Problem Domain can produce several conditions

- Divergent Stakeholders
- Lack Sufficient Information
- Unintended Consequences
- Misinformation/Defensiveness
- Instabilities
- Shifting Demands
- Politically Charged
- Emergent Situations
- High Uncertainty
- Solution Urgency
- Unclear Entry Point
- Misinformation/Defensiveness

Four Themes from this Domain

1. Complexity
   - Excessive interconnected entities
   - Changing over time
   - Emergent behavior

2. Holism
   - Systems view – whole vs. part
   - Spectrum of dimensions

3. Ambiguity
   - ‘Soft’ variables influence
   - False separation of system

4. High Context
   - Lack of clarity in understanding system
   - Cause – effect relationships difficult

Why do we seem to be frustrated in responding to this domain?

Emphasis on Global Control

Paradigm Embedded in Output Emphasis

Sprawling Complexity

Process & Event Centric

Respond to Complexity with Complication

Three Important, but often forgotten questions about systems (projects)

1. How did this come about?
2. What do we do with systems?
3. How do they fall?

3 ways complex systems (projects) come about?

1. Self-Organization
   - Structural and behavioral patterns are allowed to develop without constraint
   - without external constraint, get what you get

2. Accretion
   - Add individual parts independently as perceived they are needed
   - ad hoc piecemeal additions without priority or logic

3 ways complex systems (projects) come about?

- 3 ways complex systems (projects) come about?
3 ways complex systems (projects) come about?

**Purposeful Design**
Deliberate, holistic with specific aims and logic

- System View
  - Lean Initiative
  - ORA Staff
  - QM Programs
  - The Org
  - Asset Management
  - EVMS

Intentionally adding elements in priority and knowledge of the whole

There are only three fundamental things WE do with systems – all three drive performance

- **Design**
  - Design by ‘accretion’, ‘self-organization’, or ‘purposeful’
  - Accounting for ‘emergence’ and ‘increasing system knowledge incorporation’

- **Development**
  - Modifying the system (structure) to accommodate shifts in systems, context, or environment

- **Execution**
  - Accounting for ‘emergence’ and ‘increasing system knowledge incorporation’

Three Areas We Fail Systems

- **Design**
  - Design by ‘accretion’, ‘self-organization’, or ‘purposeful’

- **Development**
  - Modifying the system (structure) to accommodate shifts in systems, context, or environment

- **Execution**
  - Accounting for ‘emergence’ and ‘increasing system knowledge incorporation’

All this failure ---- who is responsible?

1. **Design**
2. **Execution**
3. **Development (re design)**

Complex System Governance – 3 Challenges

- Versus Management
- LNG (evolutionary) view
- Steering – Outcome - Trajectory

Complete Spectrum
System – Context – Environment
Purposeful

Complex System Governance

- Whole vs. Part
- Complexity
- Map – Act - Measure

Problem Domain ➔ CSG Response

- Complex System Governance
  - Mastering Complex by Design
Complex System Governance

Design, execution, and evolution [development] of the [nine] metasystem functions necessary to provide control, communication, coordination, and integration of a complex system
(Keating, et al. 2014)

9 Interrelated Metasystem Functions performed by all complex systems

Produces

System Viability


Part 1: 5 Take Aways

1. Our problem domain is increasingly: complex, ambiguous, holistic, contextual
2. Systems come about by self-organization, accretion, or purposeful design
3. We design, execute, and develop systems - They produce what they produce - NMNL
4. Systems performance degrades or fails in design, execution, or development
5. CSG response enhances design, execution, and development of system viability functions

Part 1: EXERCISE

CSG problem domain: This exercise explores the nature of complex problem domains and challenges participants to make an assessment of a problem domain they face.

Part 2: Complex System Governance: Foundations and Fundamentals

1. Foundations of CSG
2. Fundamentals of CSG
3. Value offered by CSG

CSG In a Nutshell

We can do better with our complex systems
Focused on direction, oversight, and accountability
Focused on communication and control
Focused on integration and coordination

Focused on field intersection
Management, Cybernetics, Systems Theory

Design, execution, and evolution [development] of the [nine] metasystem functions necessary to provide control, communication, coordination, and integration of a complex system

(Keating, et al. 2014)

3 Great CSG Challenges for Improving System Performance

- Purposeful/holistic
- Explicit
- Robust, Resilient, Viable, Antifragile
- Reasonable design
- ‘slop’ cleanup
- Minimize human costs
- De-emphasize system superheros
- Evolutionary long view
- Holistic & sustainable
- Compensate for emergent design flaws

Nine Essential Governance Functions

Nine Governance Functions

CSG Provides

- Establishes constraints necessary to ensure consistent performance and future system trajectory.
- Provides for flow and processing of information necessary to support consistent decision, action, and interpretation throughout the system.
- Provides for effective interaction to prevent unnecessary instabilities within and external to the system.
- Maintains system unity through common purpose, designed accountability, and maintenance of balance between system and constituent interests.
Nine Governance Functions

- Information & Entity: Coordination of flow of information for consistency in decision-making.
- Operational Performance: Monitoring operations to identify variance impacts.
- System Operations: Maintenance of operational performance to maintain viability.
- Environmental Scanning: Sensing the environment for trends, patterns, or events with potential system implications.
- Learning & Transformation: Identification of system-level design issues for modification.
- Strategic Monitoring: Monitoring strategic performance for variability.
- System Development: Positioning the system for future viability.
- Information & Communications: Provision of flow of information and communications for consistency in decision, action, and interpretation.
- System Viability: All systems are subject to the laws of systems.

Complex System Governance

- CSG Design: The design, execution, and evolution of the [nine] metasystem functions necessary to provide control, communication, coordination, and integration of a complex system.

Metasystem Functions

- 9 Interrelated Functions

Systems (principles)

Law in the Real World

- Unlike cartoons, real world systems conform to principles that:
  1. Don’t sleep, are always there and on
  2. Apply equally without bias or value judgments
  3. Make no allowances for ignorance
  4. Have real consequences for violations

All viable systems execute essential governance functions via mechanisms that determine system performance.

All systems are subject to the laws of systems.
The CSG Paradigm in Summary

Systems Philosophical, Theoretical, Conceptual Foundations

Metasystem Functions

Implementing Mechanisms

Governance functions can experience pathologies in their performance.

PATHOLOGY

"circumstance, condition, factor, or pattern that acts to limit system performance, or lessen system viability, such that the likelihood of a system achieving performance expectation is reduced” (Keating and Katina, 2012, p. 253)

EXAMPLE

M2.11. Introduction of uncoordinated system changes resulting in excessive oscillation.

System performance can be enhanced through purposeful development of governance functions & addressing their pathologies.
Complex System Governance - Value

CSG value accrues through rigorous examination of system performance across workforce, organizational, support infrastructure, & environment levels

Several CSG value adding benefits include:
- Rigorous self-study & mapping of target organization (system) governance, support infrastructure, environment, & performance
- Basis in advanced ‘state of knowledge’ for dealing with complexity
- Enhance workforce capacity & organizational capabilities for (holistic) systems thinking
- Identify ‘deep system’ performance constraints & feasible development strategy/priorities
- Strategic development initiative mapping & assessment of contribution & integrated fit

What CSG is NOT!

1. Magic
2. Easy
3. Prescriptive
4. “Systemtopia”

Part 2: 5 Take Aways

1. CSG is focused on design, execution, and development of 9 system functions
2. CSG functions provide communications, control, integration, and coordination
3. Pathologies act to degrade system performance
4. Value accrues from CSG self-study to address ‘deep system’ deficiencies
5. In addition to system, CSG develops: workforce, organization, support infrastructure, & environment

Part 2: EXERCISE

A 14-Point assessment that indicates the potential need for engagement in more purposeful CSG development.
Part 3: CSG Application for Complex Projects

1. CSG Deployment Perspective
2. Preparing for CSG Application

System of Interest (SOI):
- Set of entities that produce value (services/products) consumed external to the system.
- Defined by: (1) set of interacting entities producing value, (2) environment within which SOI is embedded, (3) boundary conditions that separates SOI from environment, (4) for which CSG functions are performed.

Preventing for CSG Application

CSG Getting Started – Three Instruments

What is the preliminary state of our system governance?

What is our current level of systems thinking?

What level of systems thinking is demanded by our environment?
Part 3: EXERCISE 3a

This exercise provides an indicator of ‘your’ Systems Thinking Capacity

Systems Thinking Capacity Results Overview – 7 Dimensions

<table>
<thead>
<tr>
<th>Less Systemic</th>
<th>More Systemic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stability</strong></td>
<td><strong>Emergence</strong></td>
</tr>
<tr>
<td>Focus on details, fixate on symptoms, ignore complex issues</td>
<td>Focus on whole systems, see patterns, interconnectedness, see complex issues everywhere</td>
</tr>
<tr>
<td><strong>Resilient</strong></td>
<td><strong>Simplicity</strong></td>
</tr>
<tr>
<td>Acceptance of unchangeable situations with limited control</td>
<td>Avoid complacency, adapt to change, be determined, persist, view change as a problem, multitask</td>
</tr>
<tr>
<td><strong>Resistant to Change</strong></td>
<td><strong>Yield of Change</strong></td>
</tr>
<tr>
<td>Resists change, looks at problems as a collection of independent elements</td>
<td>Combines multiple perspectives into a whole, appreciates change, views problems as interconnected, realises change is inevitable</td>
</tr>
<tr>
<td><strong>Isolation</strong></td>
<td><strong>Interconnectivity</strong></td>
</tr>
<tr>
<td>Focuses locally, does not engage with others, prefers a stable environment</td>
<td>Interconnectedness, interdependence, communication among multiple systems</td>
</tr>
<tr>
<td><strong>Integration</strong></td>
<td><strong>Independence</strong></td>
</tr>
<tr>
<td>Seeks global managers, seeks to integrate functions and local level managers for whole system performance</td>
<td>Failure to meet the demands of the environment, needs for interdependence and collaboration</td>
</tr>
</tbody>
</table>

Systems Thinking Capacity Results Overview – 7 Dimensions

1. Complexity
2. Integration
3. Interaction
4. Change
5. Uncertainty
6. Systems Worldview
7. Flexibility

Example
2. Do you prefer to work with
   a. few systems or people
   b. many systems or people

Systems Thinking Capacity

Represents the preference for engaging complexities we encounter as we navigate complex systems and environments.

- A slice of our total worldview
- Frames how we interpret and make sense of all that we encounter
- Influences our thinking, decisions, actions, and interpretations
- Determines our ‘systemic’ preference for engaging our world
Part 3: EXERCISE 3b

Assess the Environment Complexity Demand for a selected system of interest

Environment Complexity Demand

2

System Thinking Capacity Results Overview (29 responses)

Systems Thinking Capacity Results

2

Environment Complexity Demand

Overview (29 responses)

<table>
<thead>
<tr>
<th>Complexity</th>
<th>Independence</th>
<th>Flexibility</th>
<th>Interaction</th>
<th>Uncertainty</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>100 More Systemic</td>
<td>100 More Systemic</td>
<td>100 More Systemic</td>
<td>100 More Systemic</td>
<td>100 More Systemic</td>
</tr>
</tbody>
</table>

Environment Complexity Demand

Results (27 Responses)

<table>
<thead>
<tr>
<th>Complexity</th>
<th>Independence</th>
<th>Flexibility</th>
<th>Interaction</th>
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<td>100 More Systemic</td>
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</tbody>
</table>

Composite Systems Thinking Capacity and Environment Complexity Demand

<table>
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<tr>
<th>Complexity</th>
<th>Independence</th>
<th>Flexibility</th>
<th>Interaction</th>
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Example

1. Our working environment is MORE:
   a. predictable
   b. unpredictable

Aggregate

Systems Thinking Capacity and Environment Complexity Demand

From 43 Survey Questions

7 Dimensions

Provide

Systems Thinking Demand for the Environment

Part 3: **EXERCISE 3c**

Provides an assessment of the effectiveness of the 9 metasystem functions to establish a Preliminary State of CSG

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**CSG State Function Check (24 responses)**

Scoring:
1 Less effective  7 More effective

- Policy & Identity
- Context
- Strategic Monitoring
- Development
- Environmental Scanning
- Learning & Transformation
- Operations
- Operational Performance
- Info & Communications

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**CSG State Function Check (24 responses)**

Scoring:
1 Less effective  7 More effective

- Policy & Identity
- Context
- Strategic Monitoring
- Development
- Environmental Scanning
- Learning & Transformation
- Operations
- Operational Performance
- Info & Communications
Part 3: 5 Take Aways

1. Application of CSG requires a ‘system of interest’ be determined (project/program/entity)
2. Understanding Systems Thinking Capacity is essential for engagement of CSG
3. Assessing the complexity demand of the environment is necessary for engaging CSG
4. Systems Thinking Capacity must equal or exceed environment complexity demand
5. CSG state indicates the perceived level of governance effectiveness

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Part 4: Addressing Failure Modes (pathologies) In CSG

1. Failure – a systems view
2. Deep system failure modes (pathologies)
3. Metasystem Pathologies (M-Path) Method
4. EXERCISE

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Failure – a Complex System Governance View

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Complex System Failure: Perspective

- Loss of ability to satisfactorily achieve intended function (fracture or deterioration) within domain
- State of condition of not meeting or unacceptably deviating from specified or implied performance requirements
- Event that renders a system no longer capable of operation
- Degradation that lessens viability (continued existence)
- A matter of interpretation & perception for complex systems

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System Control Failure Paradigm

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What is failure?

failure [feyl-yər]*

1. an act or instance of failing or proving unsuccessful: lack of success
2. nonperformance of something due, required, or expected
3. a subnormal quantity or quality: an insufficiency
4. deterioration or decay, especially of vigor, strength, etc.
5. becoming insolvent or bankrupt
6. a person or thing that proves unsuccessful

45 Synonyms for Failure*

*definitions and synonyms from dictionary.com

We intuitively understand failure in a general sense
System Control Failure Paradigm

Hard (technical) vs. Soft (nontechnical) Failures in Complex Systems

- **Hard system failures**
  - Technical specifications
  - System requirements
  - Cost/Schedule overruns
  - Design deficiencies
- **Soft system failures**
  - Human/Social/Mgt/Org
  - System context
  - Support infrastructure
  - Environment
  - Policy/politics

Exemplars of Failure in Complex Systems

- Tenerife Collision
- Deepwater Horizon Oil Spill
- Therac 25 Cancer Treatment System
- Guidant Technologies Implantable Cardiovascular Defibrillators
- AT&T Switching Center Breakdown
- Seattle High Speed Train Crash
- Fukushima Daiichi Nuclear Power Station
- Space Shuttle Challenger
- Aegis Combat System, Iran Air Flight 655
- Tenerife Collision
- Deepwater Horizon Oil Spill
- NASA Mars Surveyor Program

When in doubt blame (the 4 usual suspects) ..... and response

1. **Human error** – (more training)
2. **Lack of sufficient procedural control** - (more processes/procedures)
3. **Insufficient management oversight** - (more management/managers)
4. **A ‘culture of complacency’** - (hire culture consultants and more training)

Deep System Failure Modes for CSG – Metasystem Pathologies
**RECALL System Pathologies – a source of unobserved failure modes**

**System Pathology**

“circumstance, condition, factor, or pattern that acts to limit system performance, or lessen system viability, such that the likelihood of a system achieving performance expectation is reduced” (Keating and Katina, 2012, p. 253)

**EXAMPLE**

M.11. Introduction of uncoordinated system changes resulting in excessive oscillation.

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**Deep System Failure: Perspective**

- Directly observable: objective, verifiable (e.g. cost, sch, perf)
- Symptomatic surface
- Deviate from requirements or expectations

- Not directly observable: subjective, difficult to verify
- Contribute to failure
- Difficult attribution of cause-effect
- Produce observed failures

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**The M-Path Method - Identification and response to system pathologies [failure modes]**

**Metasystem Pathologies (M-Path) Method**

**M-Path Identification**

1. Each of 53 pathologies are assessed for ‘existence’ and ‘impact’

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**M-Path Identification (of 53 CSG Function Failure Modes)**

- **Complex System Pathologies**
- **Linked to Nine Functions**

M-Path Identification (of 53 CSG Function Failure Modes)

1. Examine nature and implications of the unique 'landscape' of pathologies
2. Enumeration of the composite results to capture: CENTROID, VARIABILITY, RANKINGS

M-Path Analysis

1. Pathologies are represented in preparation for analysis

M-Path Exploration

1. Investigate (group) meaning of pathologies, including disparities in perspectives – FACE Validation and Triangulation
2. Identify implications for ACTIONABLE AND FEASIBLE RESPONSES
3. Map existing and planned initiatives to pathologies

CSG Development Across 5 different levels

Example Actions/Activities

1. Systems Thinking Training
2. Individual Self-Study in CSG
3. On-line Education in CSG

1. Development Workshops
2. Environmental Scanning
3. Metrics Development

1. Infrastructure Compatibility
2. Adjust Spt Infrastructure
3. Install new Spt Infrastructure

1. Contextual Analysis
2. Stakeholder Mapping
3. Competencies Development

1. Mapping/Modeling CSG
2. Initiatives Assessment
3. Strategic CSG Development
M-Path Systemic Implementation

1. Responsive strategies deployed for targeted system development
2. Understand the relationship to ongoing and planned initiatives for system development
3. Seek to PURPOSEFULLY influence the CSG landscape.

M-Path Follow-up

1. Examination of the effectiveness of the system development initiatives – has the state of CSG shifted
2. ‘Adjustment’ of initiatives, priorities, and system development resource investments

Part 4: 5 Take Aways

1. Failure in systems results in degradation in performance or loss of ability to perform mission
2. System failures can be technical or nontechnical across a spectrum of dimensions
3. Pathologies are ‘deep system’ deficiencies in functions that and degrade system performance
4. M-Path is a 5-phased approach to rigorously examine CSG pathologies
5. CSG and M-Path provide a new and novel look at system development effectiveness

Part 4: EXERCISE

Metasystem Pathologies (M-Path) Method: Phases 1 – 2 for a selected system of interest
Master Class Closeout

1. 2-Minute Essay
2. 3 Major Themes of Class – Exploiting CSG
3. Challenges to deployment of CSG

2 Minute Essay

What are your most significant insights from today’s Masterclass?

Three Major Themes for Exploiting CSG

1. Engage problem domain differently - a ‘systemic worldview’ provides new language to support different thinking, decision, action, and interpretation. EXCEED DEMAND.
2. Purposefully develop CSG functions - All systems perform CSG functions – but usually without purposeful design, execution, or development. GUIDED SELF STUDY
3. M-Path for ‘Deep system’ pathologies - critical to developing system robustness, resilience, viability, and sustainability. FOCUSED RESOURCES/INITIATIVES.

Challenges for Deployment of CSG – 8R Framework

8R Framework to Engage System Development (including CSG)

Or 8 ways to fail miserably in application of CSG

- Flexibility in design and execution of system development effort
- Relevance: Recognition of need, measurable value, comprehensive nature, and relationship to other development efforts
- Realism: Consistency between expectations and possible system development abilities
- Resolve: Institutional will and commitment to the effort and system development succeeding
- Rigor in Execution: Adherence to the design criteria and deliverables for development
- Resources: Provision for sufficient resources and access to necessary to engage in the effort
- Requisite Compatibility: Compatibility in workflows, support infrastructures, approaches, content, and risk threshold measures
- Responsibilities: Clarity in definition of roles and obligations with respect to the system and effort
6 Unstated Values of CSG Sought by Individuals

- Access to uncommon insight, foresight, & intelligence through a different frame of reference
- Resolution of ambiguity and clarity of horizon implications
- Acknowledgement of prowess by internal and external agents
- Increased capacity to influence (control, leadership, power) events, situations, people
- Heightened confidence in understanding and explanation of problematic situations
- Saving personal resources (e.g., time) through purposeful design, execution, and development

Questions, Contact and Follow-up Information

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